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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/017,734	12/18/2001	Baowei Kang	B784.312-1	8852

164 7590 03/27/2003

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EXAMINER	
NGUYEN, KHIEM D	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 03/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Offic Action Summary	Application No. 10/017,734	Applicant(s) KANG ET AL.	
	Examiner Khiem D Nguyen	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 December 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) *1* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *6* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

The non-final rejection as set forth in paper No. (5) is withdrawn in response to applicants' amendments.

A new rejection is made as set forth in this Office Action.

Claims (1-7) are pending in the application.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 6-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 6, line 1. It is unclear what "low-power-loss" power semiconductor switching devices encompass?

In claim 6, line 5. It is unclear what "finally near" is referred to. If a particular position is intended it must be clearly recited.

In claim 6, line 7, delete "general" because it does not appear to limit the claim.

In claim 6, line 9. It is unclear what "high-temperature" encompasses? If a particular ranges of temperature is intended it must be clearly recited.

In claim 6, line 9, delete "and so on" because it does not appear to limit the claim.

In claim 6, line 11, delete "such commonly used techniques as" because it does not appear to limit the claim.

In claim 6, lines 12-13. It is unclear what "a required value" encompasses? If a particular value of thickness is intended it must be clearly recited.

In claim 6, lines 14. It is unclear what "a required thickness" encompasses? If a particular value of thickness is intended it must be clearly recited.

In claim 6, line 19. It is unclear what "low temperature" encompasses? If a particular ranges of temperature is intended it must be clearly recited.

In claim 6, lines 18-19. It is unclear when only the "low-temperature processes occur".

In claim 7, line 1, delete "considered to be" because it does not appear to limit the claim.

Claim 6 recites the limitation "the low-concentration side" in line 8 and "the high-concentration side" in line 10. There is insufficient antecedent basis for this limitation in the claim.

Claim 6 recites the limitation "the general frontside structure" in line 7. There is insufficient antecedent basis for this limitation in the claim

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art of this application (AAPA) in view of Chang et al. (U.S. Patent 5,753,529).

AAPA discloses a method for fabricating low-power-loss power semiconductor switching devices wherein the fabrication is in the following sequence (See Background of the Invention on page 1-4 of this application):

fabricating a nonuniformly doped n-type substrate which contains a diffused n+ layer on one side, wherein the diffused layer, which is finally near to the backside p+ emitter, is formed in the first step of this procedure before the thinning of the substrate (page 1, line 18 to page 2, line 26);

fabricating the general frontside structure of an IGBT (page 2, lines 2-3) on the low-concentration side of the n-type substrate using ion implanting, high-temperature diffusion (page 3, lines 16-17); and

forming the backside p+ emitter with a required thickness by ion implanting into the surface of the diffused-layer (page 2, lines 5-6 and page 3, lines 18-19);

AAPA fails to explicitly disclose thinning the wafer from the high-concentration side of the substrate by grinding and polishing so that the thickness of the residual diffused-layer is decreased to a required value as recited in present claim 6.

Chang discloses (FIGS. 1-12 and related text) fabricating a frontside structure of an IGBT (col. 2, lines 5-11) on the low-concentration side of the n-type substrate 10 using ion implanting and high-temperature diffusion and thinning the wafer from the high-concentration side of the substrate by grinding and polishing so that the thickness of

the residual diffused-layer is decreased to the range of approximately between 5 and 100 μm (col. 6, lines 9-28). Chang also discloses forming the backside p+ emitter by ion implanting into the surface of the residual diffused-layer and depositing metals 104 on the surface of the backside p+ followed by sintering/alloying (col. 6, lines 29-44). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of AAPA and Chang to enable the residual diffused-layer of AAPA to be formed and furthermore to reduce the thickness of the substrate to the minimum necessary for electrical functioning of the transistors formed therein (col. 6, lines 16-19).

Neither AAPA nor Chang disclose the ranges for the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the doping concentration of the n-type residual diffused-layer and the low temperature as recited in present claims 2, 3, 5 and 7.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal ranges for the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the doping concentration of the n-type residual diffused-layer and the low temperature through routine experimentation and optimization to obtain optimal or desired device performance because the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the doping concentration of the n-type residual diffused-layer and the low temperature are result-effective variables and there is no evidence indicating the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the

doping concentration of the n-type residual diffused-layer and the low temperature are critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
March 22, 2003

George Fourson
Primary Examiner
2823